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Fibrin glue versus stapler fixation in laparoscopic transabdominal inguinal hernia repair: A single center 5-year experience and analysis of the results in the elderly

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Abstract

Introduction: Inguinal hernia surgery is one of the most common surgical procedures performed worldwide. Some studies demonstrated clear advantages of laparoscopic approach in terms of chronic pain, recurrence rate and daily life activities. Aim of this study was to compare short and long-term outcome of tacks and fibrin glue used during laparoscopic transabdominal hernioplasty (TAPP). **Methods:** This is a retrospective study conducted by our division of General Surgery. From May 2008 to May 2013 we performed 116 hernioplasty with TAPP technique. We compared two groups of patients: a group of 59 patients treated with fibrin glue and a group of 57 patients treated with conventional tacks and the two subgroups of patients over 65 years old. We evaluated: perioperative outcomes, early and late complications. **Results:** There were no significant difference about length of postoperative stay, time to return to work, recurrence rate and complications. **Discussion:** This study demonstrates that fibrin glue are same tolerated than tacks by patients and that the glues lead to the same good results during initial follow-up and in long term data also in the elderly. Meticulous preparation of the groin with preservation of spermatic sheet is in our opinion necessary to provide effective pain reduction and a good result in every TAPP procedure.

Abbreviations

TAPP, transabdominal pre-peritoneal mesh; GG, fibrin glue group; TG, tacks group; BMI, body mass index

1. Introduction

Inguinal hernia surgery is one of the most common surgical procedures performed worldwide [1].

Laparoscopic approach for hernia repair was initially controversial because various studies reported high recurrence rates [2]. However, during the last 10 years, laparoscopic surgery in hernia repair has made good results; some studies demonstrated clear advantages of laparoscopic approach in terms of chronic pain, recurrence rate and daily life activities [3].

This method has become the first choice for inguinal hernia repair in many centers [4].

About recurrence, correct fixation and the right size of the mesh are considered the most important surgical tricks in laparoscopic hernia repair to prevent recurrence and a correct method of fixation the mesh has been recommended by Deans et al. [5].

About chronic pain, the staples are defined as the most important cause of nerve injury during TAPP. The use of spiral tacker leads to an high risk of injury to the iliohypogastric nerve due to the fixation of the mesh over the muscle [6], [7], [8] and [9].

These several complication motivated surgeons to use other fixations methods like human fibrin glue and cyanoacrylate. Fibrin glue was first described by Canonico et al. in 1999 during an open hernia repair. The results of these technique are excellent in terms of chronic pain but the use of these glues increases total cost of procedure.

Aim of this study was to compare short and long-terms outcome of tacks and fibrin glue used during laparoscopic transabdominal hernioplasty (TAPP).

2. Methods

This is a retrospective study conducted by our division of General Surgery.

From May 2008 to May 2013 we performed 116 hernioplasty with TAPP technique.

Our exclusion criteria were: glaucoma, previous retinal detachment, $ASA \geq 4$, chronic obstructive pulmonary disease. Routine preoperative anesthesia was performed.

We compared two groups of patients: a group of 59 patients treated with fibrin glue (GG – Glue Group) and a group of 57 patients treated with conventional tacks (TG – Tacks Group) and the two subgroups of patients over 65 years old.

All the procedure was performed by the same surgical team using the same laparoscopic surgical standardized technique. Antibiotic prophylaxis was given as a single dose of a third-generation of cephalosporin.

Patients had comparable age, sex, type of hernia and Body Mass Index (BMI).

We evaluated: perioperative outcomes (operative time, total hospital stay, time to return to activity), early complications (seroma, bleeding, bladder injury) and late complications (recurrence rate, chronic pain, trocar site hernia).

We defined an early complication as the complication that occurred within 1 month after the surgical procedure. We defined chronic pain as pain that persisted for more than 6 months after surgery. The pain was evaluated directly from the patients using Oral Analog Scale. The main follow-up of this study was 31 months.

2.1. Surgical technique

Before surgery all patients received antibiotic and antithrombotic prophylaxis.

The patient is placed in the supine and flat position, with upper limbs abducted, under general anesthesia.

The pneumoperitoneum is created with a Veress needle placed in left hypochondrium. Semm's safety test is always performed to ensure correct intraperitoneal position of the needle and a maximal pressure of 12 mm/Hg is reached.

An umbilical 1 cm scar is performed and the alba aponeurosis and the peritoneum are opened under vision control; then the optical trocar is placed in the abdominal cavity and a 30° angle optic is introduced. It is customary to perform a carefully exploration of the totally of abdominal cavity.

To expose the inguinal hernia the table is rotated to the side opposite the wall defect and the patient was placed in Trendelenburg position.

The surgeon must stand on the opposite side of the hernia and the assistant on the right side of the patient.

After abdominal cavity exploration and all wall defects location, two other trocars are placed under direct vision. In case of bilateral inguinal hernia, all the trocars are placed on the umbilical transverse line (5–12 mm on the right and 5 mm on the left).

In case of unilateral defect the trocar placed in the same side of defect, can be introduced 2 cm above the umbilical transverse line; in the other side the trocar can be placed 2 cm below the umbilical transverse line to avoid collision with the optical trocar. So the operative triangulation is rightly pointed to the defect.

The following anatomical landmarks are identified: anterior superior iliac spine, epigastric vessels and testicular vessels laterally, iliac vessels and spermatic cord or round ligament, Cooper's ligament, symphysis and rectus muscle. An early identification of the epigastric vessels is recommended.

The dissection of the right inguinal area begins with a curved spacious incision of the peritoneum, starting in the region of the anterior superior iliac spine; the incision going above the myopectineal orifice and the orifice of the wall defect and ending at the medial umbilical ligament. That ligament

must not be cut. In case of a prominent fatty ligament, the incision should be enlarged downward or towards the cranium in a “J” shape.

The preperitoneal inguinal area is totally prepared in accordance with a strict concept: before dissecting the myopectineal orifice with the hernial sac, a preparation of the medial and the lateral compartments is always required. Dissection of the hernial sac should not be performed before demonstrating both the compartments clearly.

By following a nonvascular zone, the space of Retzius (medial compartment) as well as the Bogros space (lateral compartment) can be dissected in a blunt manner.

As a matter of principle, accurate hemostasis is required to identify landmarks and obtain excellent exposure.

Dissecting a direct hernia is a simple process: the hernia sac is dissected and separated from the transversalis fascia and reduced into the abdomen.

The femoral hernia orifice is located in an angle formed by the Cooper's ligament and the iliac vein: so the dissection needs to be performed very carefully.

Dissection of the indirect hernia is much more difficult as compared to the direct hernia, especially if the sac is long. To release and separate the hernial sac off the spermatic cord, a fine and superficial coagulation of the adhesions normally suffices.

An hernia sac of very large size (inguino-scrotal hernia) may be sectored at the neck. Extreme care has to be given to control bleeding.

The final step of dissecting the groin includes parietalisation: the peritoneum is dissected off the spermatic cord and the spermatic fascia beyond the middle region of the psoas muscle. The purpose of parietalization is to prevent the mesh from being lifted up by the remaining connective tissue during peritoneal closure; this may especially occur laterally.

During the next step, a rectangle of polypropylene mesh of about 15×10cm is used and tailored to each patient. It is advisable to use a larger mesh (12×17) for major defects. The mesh is rolled and introduced into the abdomen through a 5–12 mm trocar, positioned to cover the hernia defect and the entire inguino-femoral region (potential hernia spaces). It's important to ensure that the inferior border of the mesh stays in place when the peritoneum is lifted. The aim of mesh fixation is to prevent graft displacement and consequent recurrence.

In order to fix the mesh we can use tacks or glue. By using two clips the mesh can be fixed to the symphysis and Cooper's ligament. Two other clips are placed on the rectus muscle medial to the epigastric vessels and two other ones at the transverse fascia located lateral to the epigastric vessels. Placing clips below the ileopubic tract and 1–2 cm above is strictly avoided doing so could lead to injuring large vessels (Triangle of doom) or nerves (triangle of pain).

When fibrin glue is used, a special 5 mm laparoscopic applicator is required, and 2ml of fibrin glue is placed after heating at 37°C, with small drops around the mesh border; there is no need to look for vessels or nerve location.

As soon as the mesh is placed in position, the peritoneal incision must be approximated using a suture (prolene or adsorbable manufactured suture) whose ends get fixed with adsorbable clips or intracorporeal knotting. Peritoneum closure using clips is faster; in the patients treated with fibrin glue needs a running suture, and more laparoscopic experience is required.

At the time of suturing the peritoneum, the intra-abdominal pressure is reduced to 6–8 mmHg. Thereby allowing a tension-free peritoneal closure.

The procedure, after an accurate washing, is terminated by removing all trocars under vision because of the risk of bleeding. All 10–12 mm trocar sites need of a fascia suture because of the risk of bleeding or incisional hernia.

Skin incisions are closed by stitches. No drain into the abdomen is required.

2.2. Statistical analysis

The statistical proportions of the dichotomic variables (classification and type of hernia, number of complication) were compared using the Chi-square test and Fisher's exact test.

Continuous variables (age distribution, BMI distribution, mean operative time, postoperative length of hospital stay, operating time) are expressed as the average (range) and were analyzed using the Mann–Whitney *U* test. Patient distribution according to the two teams was verified. All statistical analyses were performed using R software; a *P* value < 0.01 was considered statistically significant.

3. Results

We performed a total of 153 hernioplasty with TAPP technique in 116 patients. The characteristic of the patients are described in Table 1.

Patient baseline characteristics	G – Group	T – Group
Patients (Over 65's)	59 (22)	57 (20)
Sex		
Male [no. (%)]	50 (84.7%)	52 (91.2%)
Female [no. (%)]	9 (15.3%)	5 (8.8%)
Age (yr) mean (Range)	58 (27–87)	58 (31–68)
BMI (Kg/m ²), mean	26	26
Hernia type		
Monolateral [no. (%)]	35 (59.3%)	9 (15.8%)
Bilateral [no. (%)]	16 (27.2%)	21 (36.9%)
Recurrence [no. (%)]	8 (13.5%)	27 (47.3%)
Indirect [no. (%)]	47 (79.7%)	48 (84.2%)
Direct [no. (%)]	12 (20.3%)	9 (15.8%)

G - Group: Glue Group: group of patients treated with glue in order to fixe the mesh.

T – Group: Tacks Group: group of patients treated with tacks in order to fixe the mesh.

BMI: Body Max Index.

Table 1 Patient baseline characteristics.

GG was composed by 59 patients (50 M, 9 F) and TG by 57 (52 M, 5 F). The mean age was 58 years of both groups; the patients over 65's was 22 in GG and 20 in TG.

The mean operative time was longer in GG but the difference was not statistically significant (Table 2).

Peri-operative outcomes	GG	GG > 65	TG	TG > 65	P	P > 65
Mean operative time (min)	81	80	75	73	ns	ns
Mean hospitalization stay (days)	1.3	1.2	1.5	1.2	ns	ns
Day to return to activity (days)	3.8	4	4.1	4	ns	ns

G – Group: Glue Group: group of patients treated with glue in order to fixe the mesh.

T – Group: Tacks Group: group of patients treated with tacks in order to fixe the mesh.

Table 2 Peri-operative outcomes in under and in over 65 years old.

The mean length of postoperative stay in hospital was 1.3 days (SD) in Glue-Group and 1.5 days (SD) in Tacks-Group in the elderly (Table 2).

The mean time to return to work was 3.8 days in Glue-Group and 4.1 in Tacks Group. There were no significant difference about length of postoperative stay and time to return to work.

Postoperative complication (early and delayed) of under and over 65's are summarized in Table 3.

Early and delayed complications	GG	GG > 65	TG	TG > 65	P	P > 65
Early complications						
Seroma [no. (%)]	2 (3.38%)	0	3 (5.26%)	0	ns	ns
Bleeding [no. (%)]	0	1 (1.69%)	0	1 (1.75%)	ns	ns
Bladder injury [no. (%)]	0	0	0	0	ns	ns
Delayed complications						
Recurrence [no. (%)]	3 (5.08%)	0	0	0	ns	ns
Chronic pain [no. (%)]	0	0	4 (7.01%)	0	ns	ns
Trocar site hernia [no. (%)]	0	0	0	0	ns	ns

G – Group: Glue Group: group of patients treated with glue in order to fixe the mesh.

T – Group: Tacks Group: group of patients treated with tacks in order to fixe the mesh.

Table 3 Early and delayed complications in under and in over 65 years old.

There was no significant difference in terms of rate of seromas, bleedings and bladder injury in any of the groups and subgroups.

We described 2 seromas in G-Group and 3 in T-Group under 65's: all the seromas healed without drainage or reoperation. There were 2 cases of bleeding due to epigastric lesion during dissection in the elderly, that were managed intraoperatively. No intraoperative major complications occurred during surgery in any of the groups.

No significant difference was observed about chronic pain. During the long term follow-up 4 patients under 65's of T-Group reported moderate chronic pain resolved by use of analgesic therapy in 4 months. No neural alcoholization was required. No significant statistical difference was observed about recurrence rate in all groups and subgroups. All recurrence (3) was observed in G-Group under 65's between 2 and 4 months after surgery. Our total recurrence rate after hernioplasty with TAPP technique was 2.58%. There was no trocar site hernia.

4. Discussion

There have been a large number of studies of comparison of fibrin glue versus stapled fixation in laparoscopic repair of inguinal hernia published in the last decade.

Some reports demonstrate better short-term pain results in patients who underwent TAPP repair with FS versus staple fixation. Placing a tack in anatomical in the “no go” regions is very dangerous; it is represented by the triangle of doom and the triangle of pain. Hindmarsh et al. [10] observed that If we placed a tack on the pubic tubercle will invariably lead to a high percentage of postoperative pain. Fibrin glue application want to avoid these complications. This study wants to investigate this aspect.

In our experience no difference about mean operative time were observed between G-Group and T-Group in elderly. However operative time of G-Group is longer by about 6 min mean compared with the T-Group; this is due primarily to the preparation of the glue and its accurate application. In literature rate of hematomas is <1%, seroma 4% and infection rate is 42% mean [11]. In our experience all the minor complication were treated with non invasive therapy. Some studies demonstrate high rate of chronic pain[12], [13] and [14]. In our experience all the chronic pain occurred in T-group and its total rate was 3.4%. This pain is due to dissection and nerve injury by penetrating mesh fixation devices such as staples.

In our experience there weren't incisional hernia after hernioplasty with TAPP technique. We always performed fascial suture to secure the site port for the prevention of post-operative trocar site hernia. Our recurrence rate is lower than could have been expected from the literature [15]. All recurrence appeared as indirect hernias and occurred in G-Group. Incorrect dilution of glue and not right size of the mesh were the cause of recurrence.

In all cases we performed re-TAPP using a Polypropylene mesh fixed with absorbable tacks. In some studies the use of fibrin glue was less expensive than stapling [16]. In our experience costs of two fixing methods were comparable.

This study demonstrates that mesh fixation with fibrin glue appears to be equally effective than stapling methods. In our experience there was no statistical superiority of one of methods. Several studies demonstrated the efficacy of fibrin glue [17] and [18] and its superiority over stapler [16], [19], [20], [21],[22], [23] and [24].

In spite of other authors that reported better short term pain in TAPP with fibrin glue, in our experience fibrin glue was not superior to stapling; we explain this with the use of standardized technique that allows to minimize the error.

We consider essential to perform a proper laparoscopic learning curve and to teach a correct technique to young surgeon [25], [26], [27] and [28].

Indeed, is evident that staple mesh fixation is safe in the hands of an expert laparoscopic hernia repair surgeon [29]. Surgery could be more difficult in elderly patients [30] but we consider laparoscopy as feasible in emergency [31] and it is a secure technique in young patients and in the elderly [32], [33], [34],[35], [36], [37] and [38] also in wound defects repair.

This study demonstrates that fibrin glue are same tolerated than tacks by patients and that the glues lead to the same good results during initial follow-up and in long term data.

Meticulous preparation of the groin with preservation of spermatic sheet is in our opinion necessary to provide effective pain reduction and a good result in TAPP procedure.

Large randomized prospective trial are required to demonstrate the real advantages of either fixation methods in presence of standardized technique and perfect knowledge of anatomy.

Ethical approval

None required.

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Author contribution

Alessia Ferrarese: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data; also participated substantially in the drafting and editing of the manuscript.

Silvia Marola: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Alessandra Surace: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Alessandro Borello: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Marco Bindi: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Jacopo Cumbo: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Mario Solej: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Stefano Enrico: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Mario Nano: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

Valter Martino: Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data; also participated substantially in the drafting and editing of the manuscript.

Conflicts of interest

All Authors have no conflict of interests.

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